



**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant : Zhi-Zhong Liang  
Appl'n. No. : 09/622,781  
Filed : November 20, 2000  
Title : LIGNIN BASED COLLOIDAL COMPOSITIONS  
Grp./A.U. : 1712  
Examiner : Daniel S. Metzmaier  
Docket No. : 6900-255 MIS/jb  
Date : September 17, 2003

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Commissioner of Patents  
P.O. Box 1450  
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U.S.A.

**AMENDMENT AFTER FINAL ACTION**  
(Response under 37 CFR 1.116 - Expedited Procedure)

Sir:

In response to the Office Action of April 22, 2003, please amend the  
above-identified application as follows:

OK.  
to ENTER  
ASW  
10/7/03

Amendments to the Claims:

1. (Currently amended) An anhydrous bituminous composition, consisting essentially of:

bitumen, and

dewatered lignin-containing spent alkaline pulping liquor stably dispersed therein.

2. (Previously amended) The bituminous composition of claim 1 wherein said dewatered spent alkaline pulping liquor is present in an amount of no more than about 50 wt% of the bitumen.

3. (Original) The bituminous composition of claim 2 wherein said dewatered spent alkaline pulping liquor is present in an amount of from about 5 to about 25 wt% of the bitumen.

4. (Currently amended) A bituminous composition, consisting essentially of:

bitumen, and

dewatered lignin-containing spent alkaline pulping liquor stably dispersed therein wherein said dewatered spent alkaline pulping liquor comprises an anhydrous colloidal dispersion of lignin in a lubricating oil.

5. (Currently amended) A bituminous composition, consisting essentially of:

bitumen, and

dewatered lignin-containing spent alkaline pulping liquor stably dispersed therein wherein said dewatered spent alkaline pulping liquor comprises a stable, substantially anhydrous, colloidal dispersion of lignin in the bitumen.

6. (Original) The bituminous composition of claim 1 wherein the spent alkaline pulping liquor is black liquor from a Kraft pulp mill.

7. (Currently Amended) A method of producing a bituminous composition, which comprises:

converting an aqueous colloidal dispersion of lignin liquor in spent pulping liquor to an anhydrous colloidal dispersion of lignin in a lubricating oil by mixing a lubricating oil with the spent pulping liquor, and

dewatering the mixture so formed at an elevated temperature to form a cream-like paste compatible with bitumen, and

mixing said anhydrous colloidal dispersion of lignin with bitumen.

8. (Cancelled)

<sup>2</sup> ~~8.~~ (Currently amended) The method of claim <sup>1</sup> ~~8~~ wherein said mixing step is effected in the presence of a surfactant to facilitate colloidal dispersion of the spent pulping liquor in the lubricating oil.

<sup>3</sup> ~~10.~~ (Original) The method of claim <sup>2</sup> ~~8~~ wherein said surfactant is an anionic surfactant.

~~11.~~ (Original) The method of claim 10 wherein the anionic surfactant is a fatty acid linear alkyl sulfonate.

11. (Cancelled)

<sup>8</sup> ~~12.~~ (Previously Amended) A method of producing a composition, which comprises:  
converting an aqueous colloidal dispersion of lignin in spent pulping liquor to an anhydrous colloidal dispersion of lignin in a lubricating oil, and  
blending the anhydrous colloidal dispersion of lignin in a lubricating oil with bitumen.

<sup>5</sup> ~~13.~~ (Original) The method of claim <sup>1</sup> ~~7~~ wherein said spent pulping liquor is black liquor from a Kraft pulp mill.

<sup>6</sup> ~~14.~~ (Currently Amended) The method of claim <sup>1</sup> ~~7~~ wherein the spent pulping liquor is present in the aqueous colloidal suspension in an amount of about 10 to about 60 wt% of the final composition.

<sup>7</sup>~~15~~. (Currently Amended) The method of claim <sup>6</sup>~~14~~ wherein the spent pulping liquor is present in the aqueous colloidal suspension in an amount of about 25 to 40 wt% of the final composition.

<sup>9</sup>~~16~~. (Original) A method of producing a bituminous composition, which comprises:  
converting an aqueous colloidal dispersion of lignin in spent alkaline pulping liquor to an anhydrous colloidal dispersion of lignin in a lubricating oil, and  
mixing said anhydrous colloidal dispersion of lignin with bitumen.

<sup>10</sup>~~17~~. (Original) The method of claim <sup>9</sup>~~16~~ wherein said spent alkaline pulping liquor is black liquor from a Kraft pulp mill.

<sup>11</sup>~~18~~. (Previously amended) The method of claim <sup>9</sup>~~16~~ wherein said converting step is effected by dewatering at elevated temperature.

<sup>12</sup>~~19~~. (Original) The method of claim <sup>11</sup>~~18~~ wherein said elevated temperature is about 100° to about 180°C.

<sup>13</sup>~~20~~. (Original) The method of claim <sup>12</sup>~~19~~ wherein said temperature is about 110° to about 160°C

<sup>14</sup>~~21~~. (Original) A method of producing a bituminous composition which comprises:  
treating bitumen with an inorganic acid at an elevated temperature to provide acid-treated bitumen,  
slowly adding to the acid-treated bitumen a lignin-containing spent alkaline pulping liquor, while agitating the bitumen to effect controlled dewatering of the spent pulping liquor to form a stable, substantially anhydrous colloidal dispersion of lignin in the bitumen.

<sup>15</sup>~~22~~. (Original) The method of claim <sup>14</sup>~~21~~ wherein said inorganic acid treatment of bitumen is effected to convert the bitumen structure from a sol to a gel, lower the temperature susceptibility of the asphalt and improve the stability of the additive dispersion in the treated bitumen.

- <sup>16</sup>~~23~~. (Original) The method of claim <sup>15</sup>~~22~~ wherein said inorganic acid is added slowly to the bitumen at an elevated temperature to avoid foaming to provide an inorganic acid content of said bitumen of about 0.2 to about 3.5 wt%.
- <sup>17</sup>~~24~~. (Original) The method of claim <sup>16</sup>~~23~~ wherein said inorganic acid content is from about 0.5 to about 2.5 wt% of the bitumen.
- <sup>18</sup>~~25~~. (Original) The method of claim <sup>14</sup>~~21~~ wherein said inorganic acid is sulfuric acid.
- <sup>19</sup>~~26~~. (Original) The method of claim <sup>14</sup>~~21~~ wherein said addition step is effected by:  
initially slowly adding the spent alkaline pulping liquor to the acid-treated bitumen at substantially water boiling temperature while agitating the bitumen to effect an initial dewatering of the alkaline spent pulping liquor, and  
subsequently increasing the temperature of the bitumen above the water boiling point to effect a further dewatering of the bitumen to form the stable, substantially anhydrous, colloidal dispersion of lignin in the bitumen.
- <sup>20</sup>~~27~~. (Original) The method of claim <sup>14</sup>~~21~~ wherein said spent alkaline pulping liquor is black liquor from a Kraft pulp mill operation.
- <sup>21</sup>~~28~~. (Original) The method of claim <sup>14</sup>~~21~~ wherein said elevated temperature is about 100° to about 180°C.
- <sup>22</sup>~~29~~. (Original) The method of claim <sup>21</sup>~~28~~ wherein said temperature is about 110° to about 160°C.
- <sup>23</sup>~~30~~. (Original) The method of claim <sup>14</sup>~~21~~ wherein the spent pulping liquor is present in an amount of about 5 to about 50 wt% of the composition.
- <sup>24</sup>~~31~~. (Original) The method of claim <sup>14</sup>~~21~~ wherein the spent pulping liquor is present in an amount of about 10 to about 30 wt%.